

EFFECT OF FERTILIZER LEVELS AND SOWING METHODS ON EARLINESS AND GRAIN YIELD OF SOME BREAD WHEAT

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ABSTRACT: Two field experiments were conducted at the Farm of Kuotor - EL- Gharbia Governorate during 2016/2017 and 2017/2018 growing seasons to study the effect of three sowing methods [Broadcasting on beds method, Drilling on beds method and Hills on beds method] and three seeding rates (45, 52.5 and 60 kg seeds/fad.) on growth and yield of three bread wheat cultivars (*Triticum aestivum* L.). Raised hills on bed sowing method was better for growing wheat plants and gradually increased grain yield/fad than drilling on bed and broadcasting on bed method (3.45 and 13.74%) in the first and (7.47 and 20.19 %) in the second seasons, respectively. Giza 171 gave the highest on heading date, flag leaf area, FLA (cm)², date of maturity, plant height (cm.), spike length (cm.) and grain yield compared with the other varieties in both seasons. Planting by hills on bed method increased significantly flag leaf area, plant height (cm.), spike length (cm.) and grain yield compared with the other sowing methods in the first and second seasons. The highest values of flag leaf area, FLA (cm)², spike length (cm.) and grain yield were found with seed rates 45 kg/fad. in both seasons. The highest values grain yield were found Giza 171 and hills on bed with seed rates 45 kg/fad. in both seasons, while, the interaction between Shandaweel 1 and broadcasting on bed with 45 kg/fad. recorded the lowest values in both seasons, respectively.

Key words: wheat cultivars, sowing methods, grain yield and its components and seeding rates.

INTRODUCTION

Wheat is considered the most important productive cereal crop in the World (Coventry *et al.*, 2011). Therefore, it has a strategic position with competition for many other crops produced in the world. This importance comes from its use principally in human food in many world countries especially Egypt, where it is used in bread production and also several food industries.

Wheat (*Triticum aestivum*, L.) has been considered the first strategic food crop for more than 7000 years in Egypt. It has maintained its position during that time as the basic staple food in urban areas and mixed with maize in rural areas for bread making. In addition, wheat straw is an important fodder (Gomaa, 1999).

Raising wheat production through increasing productivity and increasing the cultivated area is an important national target to minimize the gap between the Egyptian production and consumption. The total production of wheat reached at least 9 million tons annually (FAO, 2016); while, the annual consumption of wheat grains in Egypt is about 15 million tons. Increasing wheat yield per unit area can be achieved by breeding high yielding varieties or improving the cultural treatments of the crop. New wheat varieties were developed to maximize grain yield under favorable environmental conditions (high input

conditions especially planting methods to save water supply and seeding rate).

Egypt imports above 5.5 million tons of wheat grains. Unless domestic wheat production increases, the deficit will increase due to the increased birth rate (about 2%) and present the high per-capita consumption which is estimated by 180 kg /year*. More than 3 million faddans are cultivated annually with wheat. The average productivity is about 2.7 ton/fad; where the recent high yielding wheat varieties have been cultivated.

Several investigators showed that wheat cultivars differed in yield and its components as well as chemical properties (Hassan, 2008, Ashmawy *et al.*, 2010, Mehasen *et al.*, 2015). Also (Zenhom *et al.*, 2018) reported that wheat cultivars were varied significantly in plant height, No. spikes/m, seed index and grain yield/fed.

Optimum seeding rate may be of treatments main to increase wheat yield by improving yield components of wheat plants and applying the scientific recommendations in that respect.

MATERIALS AND METHODS

Two field experiments were carried out in the Middle of Nile Delta (the Private Farm

of Kuotor - EL- Gharbia Governorate) during the two successive seasons of 2016/17 and 2017/18 to study the effect of three sowing methods and three seeding rates on growth, yield and yield components of three bread wheat cultivars (*Triticum aestivum* L.).

The experimental design was a split-split-plot design with three replications in both seasons. The main plot treatments were occupied by the three wheat cultivars, while the three sowing methods were assigned in the sub-plots and the three seeding rates in the sub-subplots. Sowing dates were 15th November in the first season and 20th November in the second one. The harvest area was 7.2 m², (2.4 width and 3m in length).

Soil chemical analysis

The soil of the experimental site of Kuotor is clay in texture and fairly uniform without distinct changes in texture. Soil samples were taken before sowing during the two seasons at soil depth of 0-30 cm and 30-60 cm. Some soil physical and chemical characteristics of the experimental site were determined and presented in Table (1).

The following data was recorded during the growing seasons at and after harvest as follows:

A. Growth characteristics:

A.1. Date of expulsion: Number of days from sowing to the date when 50% of spikes complete emergence from flag leaf of the plot.

A.2. Flag leaf area, FLA (cm)²: Mean areas of flag leaves of ten random leaves within each plot were separated and their green area were measured using a LI-3100 (LI-COR, Lincoln, Nebraska, USA) leaf area meter, according to **Watson et al. (1963)**.

FLA= (leaf length x maximum width of flag leaf x 0.75) at 125 days.

A.3. Date of maturity: Number of days from sowing to date when 50% of spikes and top of the peduncles turned yellow of the plot.

A.4. Plant height (cm.): Plant length from the soil surface to the tip of the spikes, excluding awns.

B-Yield and its components:

At harvest, ten wheat plants were chosen at random from each plot to study the following characters:

B.1. Spike length (cm.): Ten main spikes were chosen; their average was calculated to express spike length in cm.

B.2. Number of spikes/m²: Number of fertile tillers/m² was calculated by counting all spikes per square meter.

B.3. Number of kernels/spike: It was counted as an average number of grains collected per spike.

B.4. 1000-grain weight (g): A random sample of 1000-grains was taken from each plot, hand counted and weighted.

B.5. Grain weight /spike (g): Average number of grains of ten randomly chosen spikes and weighted.

B.6. Grain yield (ardab/fad): Recorded for the harvested area after threshing and then converted to ardab/fad (One ardab = 150 kg on the basis of 14.5% moisture content and one faddan = 4200 m²).

B.7. Straw yield (ton/fad.): Determined as the difference between biological and grain yield of sub plot in terms of kg/plot and converted to ton/fad.

B.8. Biological yield (ton/fad.): It was recorded for the harvested area and converted to ton/fad.

B.9. Harvest index (HI): It was recorded as a ratio of grain yield to the total biological yield.

HI= (Grain yield / Biological yield) × 100

Statistical analysis:

Data were subjected to the proper statistical analysis as the technique of analysis of variance (ANOVA) of split-split plot design as mentioned by **Gomez and Gomez (1984)**. Treatment means were compared using the Least Significant Difference (LSD) test as outlined by **Waller and Duncan (1969)**.

RESULTS AND DISCUSSION

A- wheat cultivars:

Results in Tables (2) and (3) showed that Giza 171 gave the highest on heading date, flag leaf area, FLA (cm)², date of maturity, plant height (cm.), spike length (cm.) and grain yield, while, the wheat cultivar Shandaweel 1 recorded the lowest values in both seasons. This result due to it's a genetic character specific to the cultivar and the differences may be due to variability among the wheat cultivars under study which considered adequate for further biometrical assessment. These results are in harmony with those obtained by **El-Samahy (2009)**, **Rahman et al., (2010)**, **El-Hag (2012)**, **El-Hag (2015)**, **El-Seidy et al., (2016)** and **Wogene and Anjulo (2017)**.

B- Sowing methods:

Sowing methods had significantly effect on heading date, flag leaf area, FLA (cm)², date of maturity, plant height (cm.), spike length (cm.) and grain yield in both seasons, as shown as in Tables (2) and (3).

The hills on bed sowing method recorded the highest flag leaf area, plant height (cm.), spike length (cm.) and grain yield, while, the broadcasting on bed method recorded the highest values on heading date and date of maturity in both seasons. These results are in harmony with those obtained by **Wang *et al.*, (2011)**, **Ali *et al.*, (2012)**, **Genedy (2014)**, **El-Hag (2015)**, **Abdul Razaq *et al.*, (2016)**, **El-Seidy *et al.*, (2016)** and **Singh *et al.*, (2017)**.

C- Seeding rates:

Regarding the effect seeding rates on heading date, flag leaf area, FLA (cm)², date of maturity, plant height (cm.), spike length (cm.) and grain yield was highly significant in both seasons, as shown as in Tables (2) and (3).

The highest values of heading date, date of maturity and plant height (cm.) were found with seed rates 60 kg/fad in both seasons, while, the lowest values were recorded from using 45 kg/fad in both seasons. On another hand added 45 kg seed/fad. recorded the highest flag leaf area, FLA (cm)², spike length (cm.) and grain yield in both seasons. These results are in agreement with **Avijit-Sen *et al.* (2003)**, **Boyd *et al.*, (2009)**, **Laghari *et al.*, (2011)**, **Gross *et al.*, (2012)**, **Javaid Iqbal *et al.*, (2012)**, **Said *et al.*, (2012)**, **May *et al.*, (2014)**, **Naveed *et al.*, (2014)**, **Al-Hilfy and Wahid (2017)** and **Tadesse *et al.*, (2017)**.

D- Interaction:

Results indicated that sowing methods and seeding rates significantly affected in all the studied characters, as shown as in Tables (2) and (3).

The interactions between cultivars and sowing methods (C x M) was highly significant concerning with flag leaf area and grain yield in both seasons as shown as in Tables (2) and (3). While the interaction between cultivars and sowing methods on heading date, date of maturity, plant height (cm.), spike length (cm.) was not significant in both seasons. These results are in full agreement with those of **Soomro *et al.*, (2009)** and **Kiliç (2010)**.

The interaction between cultivars and seeding rates (C x S) on flag leaf area, date of

maturity and grain yield was highly significant in both seasons, as shown as in Tables (2) and (3). While the interaction between cultivars and seeding rates on heading date, plant height and spike length (cm.) was not significant in both seasons. as shown as in Tables (2) and (3). These results are in full agreement with those of **Soomro *et al.*, (2009)** and **EL Hag (2016)**.

The interaction between sowing methods and seeding rates (M x S) on flag leaf area and grain yield (ardab/fad.) was highly significant in both seasons, as shown as in Tables (2) and (3). Effect interaction between sowing methods and seeding rates on date of maturity was significant in second season only, as shown in Table (2). While the interaction between sowing methods and seeding rates on heading date, plant height (cm.), spike length (cm.) was not significant in both seasons. These results are in a good accordance with those obtained by **Balkaran (2011)**, **El-Lattief (2011)** and **Tadesse *et al.*, (2017)**.

The interaction between cultivars, sowing methods and seeding rates (C x M x S) on flag leaf area, date of maturity and grain yield (ardab/fad.) was highly significant in both seasons, as shown as in Tables (2) and (3), while, heading date, plant height (cm.), spike length (cm.) was not significant in both seasons.

Table (1): Physical and some chemical properties of the experimental soil during 2016/17 and 2017/18 season.

Properties	2016/17	2017/18
<u>Mechanical analysis :</u>		
Sand %	22.73	21.95
Silt %	31.50	31.85
Clay %	45.80	46.17
Soil texture	Clay	Clay
<u>Chemical analysis :</u>		
pH	8.30	8.05
Ec dS / m	2.30	2.34
O.M %	1.80	1.85
Available N (mg/kg)	31.80	30.79
Available P (mg/kg)	7.01	6.01
Available K (mg/kg)	119.00	121.02
Available Zn (mg/kg)	0.21	0.27
<u>Cation (meq / L) :</u>		
Ca ⁺⁺	12.85	13.04
Mg ⁺⁺	10.23	11.85
Na ⁺	42.08	41.22
K ⁺	51.37	53.07
<u>Anion (meq / L) :</u>		
CO ₃ ⁻	0.02	0.05
HCO ₃ ⁻	2.87	2.93
Cl ⁻	62.57	63.45
SO ₄ ⁻	49.88	51.07

Table (2): Effect of cultivars, sowing methods, seeding rates and their interactions on heading date (day), flag leaf area, FLA (cm)² and date of maturity (day) at harvest in 2016/17 and 2017/18 seasons.

Characters Treatments	Heading date (day)		Flag leaf area, FLA (cm) ²		Date of maturity (day)	
	Season 2016/17	Season 2017/18	Season 2016/17	Season 2017/18	Season 2016/17	Season 2017/18
A: Cultivars (C)						
Shandaweel 1	91.78	87.44	48.83	43.54	136.15	130.11
Gemmeiza 11	94.11	90.33	50.79	45.41	139.59	132.85
Giza 171	96.33	92.56	52.98	47.62	140.07	135.00
F-test	**	**	**	**	**	**
LSD at 0.01	2.88	2.55	1.15	1.27	0.98	1.17
B: Sowing methods (M)						
Hills	94.00	89.33	60.81	55.53	137.56	131.70
Drilling	91.22	87.11	48.16	42.79	134.82	128.82
Broadcasting	97.00	93.89	43.62	38.26	143.44	137.44
F-test	**	**	**	**	**	**
LSD at 0.01	1.60	1.61	0.75	0.81	2.93	2.94
C: Seeding rates (S)						
45 Kg/fad.	91.00	86.44	53.95	48.68	135.37	129.37
52.5 Kg/fad.	94.00	90.22	51.24	45.87	138.19	132.30
60 Kg/fad.	97.22	93.67	47.40	42.03	142.26	136.30
F-test	**	**	**	**	**	**
LSD at 0.01	0.80	0.81	0.35	0.37	0.80	0.75
D: Interactions effects						
C x M	NS	NS	**	**	NS	NS
C x S	NS	NS	**	**	**	**
M x S	NS	NS	**	**	NS	*
C x M x S	NS	NS	**	**	**	**

*and ** Significant at 0.05 and 0.01 levels of Probability, respectively, while NS means non-Significant.

Table (3): Effect of cultivars, sowing methods, seeding rates and their interactions on plant height (cm.), spike length (cm.) and grain yield (ardab/fad.) at harvest in 2016/17 and 2017/18 seasons.

Characters Treatments	Plant height (cm.)		Spike length (cm.)		Grain yield (ardab/fad.)	
	Season 2016/17	Season 2017/18	Season 2016/17	Season 2017/18	Season 2016/17	Season 2017/18
A: Cultivars (C)						
Shandaweel 1	96.11	93.63	12.74	12.46	19.70	17.13
Gemmeiza 11	100.67	99.26	13.37	13.09	21.66	18.32
Giza 171	104.74	103.15	14.52	14.17	22.41	19.15
F-test	**	**	**	**	**	**
LSD at 0.01	2.24	2.97	0.50	0.71	0.19	0.23
B: Sowing methods (M)						
Hills	106.70	104.15	15.13	14.82	22.41	19.76
Drilling	102.15	99.15	13.32	12.98	21.66	18.39
Broadcasting	92.67	92.74	12.19	11.93	19.70	16.44
F-test	**	**	**	**	**	**
LSD at 0.01	1.54	1.75	0.57	0.66	0.12	0.12
C: Seeding rates (S)						
45 Kg/fad.	96.11	94.74	14.57	14.24	21.68	18.58
52.5 Kg/fad.	100.59	98.52	13.52	13.26	21.10	18.11
60 Kg/fad.	104.82	102.78	12.54	12.22	20.99	17.90
F-test	**	**	**	**	**	**
LSD at 0.01	1.43	1.55	0.34	0.39	0.11	0.12
D: Interactions effects						
C x M	NS	NS	NS	NS	**	**
C x S	NS	NS	NS	NS	**	**
M x S	NS	NS	NS	NS	**	**
C x M x S	NS	NS	NS	NS	**	**

*and ** Significant at 0.05 and 0.01 levels of Probability, respectively, while NS means non-Significant.

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"تأثير مستويات التسميد وطرق الزراعة على صفات التبيكر والمحصول لبعض أصناف القمح"

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أجريت هذه التجربه خلال موسمی ٢٠١٦ / ٢٠١٧ ، ٢٠١٧ / ٢٠١٨ بمرکز قطور محافظة الغربيه لدراسة تأثير بعض الطرق الزراعيه المختلفه (الزراعة البدار على المصاطب، التسطير على المصاطب، النقر على المصاطب) وثلاث معدلات تقاوى (٤٥ ، ٥٢,٥ و ٦٠ كجم / فدان) على صفات التبيكر والمحصول لبعض أصناف القمح. وقد استخدم تصميم القطع المنشقه مرتين في ثلاث مكررات حيث إحتوت القطع الرئيسييه على الأصناف والقطع الشقيه الأولى على طرق الزراعة والقطع الشقيه الثانيه على معدلات التقاوى.

ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلي :-

- ١- أظهرت النتائج أن تأثير الأصناف كانت عالية المعنويه على كل من تاريخ الطرد، مساحة الورقة العلم، تاريخ النضج، ارتفاع النبات، طول السنبله ومحصول الحبوب. سجل الصنف جيزة ١٧١ أعلى القيم لكل من تاريخ الطرد، ومساحة الورقة العلم، تاريخ النضج، ارتفاع النبات، طول السنبله ومحصول الحبوب بينما سجل الصنف شندويل ١ أقل القيم في كل من الموسمين.
- ٢- أشارت النتائج الى أن تأثير طرق الزراعة كانت عالية المعنويه على كل من تاريخ الطرد، مساحة الورقة العلم، تاريخ النضج، ارتفاع النبات، طول السنبله ومحصول الحبوب. طريقة الزراعة البدار على المصاطب سجلت أعلى القيم لكل من تاريخ الطرد وتاريخ النضج في كل من الموسمين. بينما سجلت طريقة الزراعة بالنقر على المصاطب أعلى القيم لكل من مساحة الورقة العلم، ارتفاع النبات، طول السنبله ومحصول الحبوب في كل من الموسمين.
- ٣- أوضحت النتائج أن تأثير معدلات التقاوى كانت عالية المعنويه على كل من تاريخ الطرد، مساحة الورقة العلم، تاريخ النضج، ارتفاع النبات، طول السنبله ومحصول الحبوب. إضافة معدل التقاوى ٦٠ كجم/فدان سجل أعلى القيم من تاريخ الطرد، تاريخ النضج وارتفاع النبات في كل من الموسمين. بينما سجل معدل التقاوى ٤٥ كجم/فدان أعلى القيم لكل من مساحة الورقة العلم، طول السنبله ومحصول الحبوب في كل من الموسمين.
- ٤- أظهرت النتائج أن تأثير التفاعل بين الأصناف، طرق الزراعة ومعدلات التقاوى كان عالي المعنويه على كل من مساحة الورقة العلم، تاريخ النضج ومحصول الحبوب في كل من الموسمين. بينما كان التفاعل غير معنوى على كل من تاريخ الطرد، ارتفاع النبات وطول السنبله في كل من الموسمين. حيث أعطى التفاعل بين الصنف جيزة ١٧١ وطريقة الزراعة بالنقر على المصاطب مع معدل التقاوى ٤٥ كجم/فدان أعلى القيم من محصول الحبوب في كل من الموسمين.